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INNOVATIVE APPROACHES TO THE DEVELOPMENT OF ENGINEERING AND TECHNICAL EDUCATION

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Abstract

This article analyzes the strategic directions of modern engineering and technical education. It discusses the reforms being implemented in the higher education system, the integration of education with production, and the importance of innovative approaches in training qualified personnel. The author justifies the need to modernize engineering education in the context of technological innovations in industry, changes in the labor market, and global trends. It also considers the problems and solutions of effectively organizing independent work in distance education and improving the quality of education in harmony with science.

Keywords: Engineering education, innovation, technical personnel, technological transformation, higher education, distance learning, internship, science-education integration.

Introduction

One of the priorities of modern development is the task of technological innovation, production based on scientific achievements, and the creation of a modern competitive economy. Fundamental changes in the global labor market, the training of personnel who meet the requirements of the fourth industrial revolution (Industry 4.0) are recognized as a factor ensuring the economic independence and sustainable development of any state. In particular, the increase in the potential of qualified personnel in the engineering and technical direction plays a decisive role in the introduction of modern technologies, the organization of new production lines, and the production of export-oriented products.

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Special attention is paid to technical education within the framework of the wide-ranging reforms being implemented at the initiative of the President of the Republic of Uzbekistan - in particular, the "Strategy of Actions" (2017-2021), the "Uzbekistan - 2030" strategy developed as its logical continuation, as well as the "Five Important Initiatives". In particular, the material and technical base of higher technical educational institutions is being updated, practice-oriented educational programs, dual system elements, innovative technoparks, IT academies and modern laboratories are being created. At the same time, the creation of educational institutions that meet the requirements of international ratings and accreditation, and the introduction of international technical education standards are being implemented to prepare Uzbek engineering personnel for the international labor market.

Among these, food safety and technological development of the agro-industrial complex are also considered one of the strategic priorities. World experience shows that by using advanced technologies in the production, storage and processing of food products, it is possible not only to sustainably provide the domestic market, but also to increase export potential. In this regard, the training of qualified engineering personnel in such areas as agroengineering, food technologies, biological engineering, and environmental protection techniques has become an urgent issue.

Today, training engineers capable of mastering modern technologies, innovative thinking, and digital competencies has become one of the main priorities for ensuring the future of New Uzbekistan. Therefore, the need to improve the quality of education in the technical field, bring it closer to the needs of production and food security, and introduce advanced international experience is increasing day by day.

Main Body

In the process of large-scale reforms implemented in the Republic of Uzbekistan in recent years, the higher education system has also undergone fundamental structural and substantive changes. In particular, a number of practical measures have been identified and are being gradually implemented to improve the quality of higher education, modernize the material and technical base of educational institutions, revise curricula based on advanced foreign experience, and train competent personnel capable of working with modern production processes.

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In this process, it is observed that special attention is being paid to the development of engineering and technical areas at the strategic level. In recent years, along with educational programs in the socio-economic direction, improving the activities of technical specialties, harmonizing engineering education with international standards and ensuring its practical effectiveness have been identified as one of the priority areas of state policy.

The growing demand for engineering personnel in the global labor market, which is closely related to population growth, technological innovations and industrial development, necessitates the further development of this educational field. According to experts, in the coming decade, the need for personnel in engineering fields will increase several times compared to the current one. This is explained by the deepening of industrialization processes, the emergence of narrowly specialized professions in production, and technological innovations.

Presidential decrees and government resolutions have identified improving the quality of education in the engineering and technical field, training a new generation of specialists, and introducing modern approaches to the educational process as priority tasks. In particular, the dual education system, modular curricula, training based on digital technologies, practical training in cooperation with technoparks and innovation centers are strengthening the integration of engineering education into the real sector.

It is also encouraging that interest in engineering professions is growing among young people, which indicates the increasing social status of education in technical areas. State grants, joint programs with foreign higher education institutions, modern laboratories and practical centers serve as an incentive for young people aspiring to this field.

As a result, a radical reform of engineering and technical education, harmonization of its internal structural structure with the requirements of the time, and formation of a generation of competitive, creatively thinking and practice-ready engineers are becoming an urgent scientific and pedagogical task today.

In today's global competitive environment, the main strategic task facing engineering education is to train qualified engineering personnel for various sectors of the economy who have deeply mastered modern, advanced technologies and are able to make complex decisions aimed at increasing the efficiency of technological processes. Such specialists should not only be able to

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work in existing technological systems, but also have the ability to improve them and find solutions to problems based on an innovative approach.

Indeed, one of the urgent tasks facing higher education institutions in the field of engineering today is to train engineers who meet the requirements of the modern labor market and can actively participate in practice in the real sector of the economy. This is considered the main mission of each engineering education field.

In this regard, the need to prepare students studying in higher education institutions in the field of engineering to work with advanced technologies, to familiarize them with modern equipment, software platforms and technological systems, and to teach them to transform theoretical knowledge into practical skills is becoming increasingly urgent. The quality of engineering education now depends not only on the content of the curriculum, but also on the degree of its direct integration with production.

Therefore, all higher education institutions that train personnel in the field of engineering are faced with the task of forming a generation of engineers who are useful in practice, modern thinkers and creative engineers, while ensuring the harmony of knowledge, skills and competencies.

Currently, the economy of the Republic of Uzbekistan is developing at a stable and consistent pace. According to data from state statistical bodies for the first quarter of 2024, growth dynamics are observed in all sectors of the economy. In particular, the volume of industrial production increased by 6.5% (in the corresponding period of 2023 this indicator was 4.1%), in the processing industry, which accounts for about 80% of production, by 7.1%, in the mining industry by 4.9%, in the electricity supply.

Therefore, it is an important strategic task to regularly update engineering education in accordance with the needs of the industry, integrate advanced scientific and technological achievements into the educational process, revise curricula, and introduce modern teaching methods. This, in turn, places a high responsibility on professors and teachers working in this area. Engineering education should be several steps ahead of technological innovations in production. Also, improving the professional skills of teachers, organizing their practice and internships at industrial enterprises, and relying on interactive, innovative teaching methods are necessary conditions for the development of this field.

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One of the important tasks facing modern engineering and technical education is to create an effective learning environment aimed at independently deepening the knowledge acquired by students. Especially in the context of distance learning, the proper organization of independent learning not only determines the quality of the educational process, but also plays an important role in the professional formation of future engineers. In this regard, practical observations and empirical analysis, especially in the case of technical higher education institutions, have identified the following problems:

Teachers lack sufficient methodological skills to monitor students' independent work in remote conditions. This situation is often explained by the fact that technical teachers, although they have knowledge in their fields, have not mastered the methodology of distance learning.

The lack of development of algorithms for the effective organization of students' independent work in accordance with modern conditions, that is, consistency, phasing and purposefulness are not sufficiently provided for in the formulation of independent tasks.

Low motivation of some students to master new knowledge, which directly negatively affects the quality of education and the effectiveness of the educational process.

To find an effective solution to these problems, each of them must be analyzed separately. In particular, the issue of the low level of methodological training of teachers is associated with the fact that technical specialists are often excluded from pedagogical training. Distance education requires not only technical knowledge, but also skills such as the use of modern information and communication technologies, adapting the educational process to a remote environment, and establishing constant interactive communication with students.

Based on the questionnaires conducted by the authors, it was found that in order to effectively organize independent work of students in distance learning conditions, teachers should have the following qualifications and competencies:

- planning independent work in distance learning and correctly formulating its content;
- organizing effective communication between participants in the educational process;
- monitoring the psychological state of students during distance communication and, if necessary, applying a psychopedagogical approach;

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- assessing students' knowledge in various forms: through tests, project assignments, oral feedback;
- adapting educational materials to the distance format and identifying areas of independent work [4].
- To form such qualifications, it is important to conduct systematic methodological work among technical universities. For example, the experience of Vinnitsa National Technical University shows that methodological seminars held at the faculty and department levels, exchange of experience between teachers, and automation of the educational process using the "JetIQ" electronic management system have increased the effectiveness of distance learning [4].

Practical observations show that many teachers limit themselves to simply digitizing existing course materials and do not rework them methodologically for distance learning. As a result, tasks and approaches that are not suitable for the distance format lead to a decrease in the quality of education. Therefore, the processing of educational materials, the creation of a step-by-step independent work system, and the definition of clear assessment criteria are of decisive importance in increasing the effectiveness of distance learning.

In any educational field, reinforcing theoretical knowledge with practical experience is an important component of the educational process. In particular, in engineering and technical education, the main support of this process is professional practice. If a student does not have the opportunity to apply the theoretical knowledge he has acquired in practice, an integral connection will not be formed between them, and this situation will prevent him from becoming a qualified specialist in the future. Testing theoretical knowledge in real production conditions and developing practical competencies based on existing technological processes are decisive factors in the quality of engineering education.

Qualifying internships will fully fulfill their mission only when they are organized based on the requirements of real production enterprises. Their effective implementation will serve the interests not only of higher educational institutions, but also of industrial enterprises. By providing students with decent working conditions at enterprises, the opportunity to work with modern technologies, and direct involvement in production processes, not only practical knowledge will be strengthened, but also a qualified personnel base for the enterprise will be formed in the future.

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Conclusion

The development of engineering education is inextricably linked with the production sector. Only when real cooperation is established between an educational institution and an enterprise will the quality of education increase, practice will be effective, and qualified engineering personnel will be trained. If the enterprise does not open its doors, does not create an opportunity to get acquainted with existing technological equipment, software, production systems, the student's knowledge remains only in the theoretical framework. As a result, the prepared engineering personnel cannot integrate into the production process, and the enterprise is not fully satisfied with the knowledge and skills of young specialists. Therefore, the active involvement of enterprises in the educational process, ensuring their participation in the development and improvement of educational programs, and organizing training practices in an integrated manner are urgent tasks today.

When it comes to improving methodological approaches and teaching methods in engineering education, these processes cannot be imagined separately from the development of science. Because no modern technical education can be effective without a scientific approach and the foundations of fundamental science. The development of science, the application of innovative developments in production, the development of new technological solutions - all this directly serves the development of engineering education. Therefore, the quality of engineering education is improved by increasing attention to scientific research in higher educational institutions that train engineering personnel, attracting students to innovative projects, and ensuring the integration of science, education, and production. The conclusion is that the sustainable and innovative development of engineering education is unthinkable without science, that is, without advanced scientific ideas and technological achievements.

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